

CLAIMS

- 1 1. A method of predicting the health of a plurality of tools based on temporally ordered
2 input data representing parameters indicative of tool health, the method comprising the steps of:
3 using a sliding time window to partition the input data into temporally displaced data
4 sets;
5 using non-linear regression to determine, based on the data sets, a set of predictive values
6 relating to tool health at a future time; and
7 determining a tool-health metric based on one or more of the predictive values.
- 1 2. The method of claim 1, wherein the tool-health metric is likelihood of tool failure.
- 1 3. The method of claim 1, wherein the data sets include only historical data.
- 1 4. The method of claim 1, wherein the data sets include discrete representations of
2 continuous data.
- 1 5. The method of claim 4, wherein the data sets include Fourier coefficients.
- 1 6. The method of claim 4, wherein the data sets include wavelet coefficients.
- 1 7. The method of claim 1, wherein the data sets include operational data.
- 1 8. The method of claim 1, wherein the data sets include maintenance data.

1 9. The method of claim 1 further comprising creating intermediate neural networks for
2 subsets of the data in the data sets.

1 10. The method of claim 9 further comprising creating an overseer neural network to
2 accept outputs from the intermediate neural networks as input and to produce the tool health
3 metric as output.

1 11. The method of claim 10 further comprising using a moving average to smooth the
2 output of the overseer network.

1 12. A system for predicting the health of a plurality of tools based on temporally ordered
2 input data representing parameters indicative of tool health, the apparatus comprising:
3 a data module for receiving the input data; and
4 an analysis module for (i) partitioning the input data into temporally displaced data
5 sets, (ii) using non-linear regression to determine, based on the data sets, a set of predictive
6 values relating to tool health at a future time, and (iii) determining a tool-health metric based
7 on one or more of the predictive values.

1 13. The system of claim 12, wherein the tool-health metric is likelihood of tool failure.

1 14. The system of claim 12, wherein the data sets include only historical data.

1 15. The system of claim 12, wherein the data sets include discrete representations of
2 continuous data.

1 16. The system of claim 15, wherein the data sets include Fourier coefficients.

- 1 17. The system of claim 15, wherein the data sets include wavelet coefficients.
- 1 18. The system of claim 12, wherein the data sets include operational data.
- 1 19. The system of claim 12, wherein the data sets include maintenance data.
- 1 20. The system of claim 12 wherein the analyzer further creates intermediate neural
2 networks for subsets of the data in the data sets.
- 1 21. The system of claim 20 wherein the analyzer further creates an overseer neural
2 network to accept outputs from the intermediate neural networks as input and to produce the
3 tool health metric as output.
- 1 22. The system of claim 21 wherein the analyzer uses a moving average to smooth the
2 output of the overseer network.
- 1 23. A system for predicting the health of multiple tools based on temporally ordered input
2 data representing parameters indicative of tool health, the system comprising:
3 means for receiving input data;
4 means for partitioning the input data into temporally displaced data sets;
5 means for using a non-linear regression model to determine a set of predictive values
6 relating to tool health at a future time; and
7 means for determining a tool-health metric based on the set of predictive values.